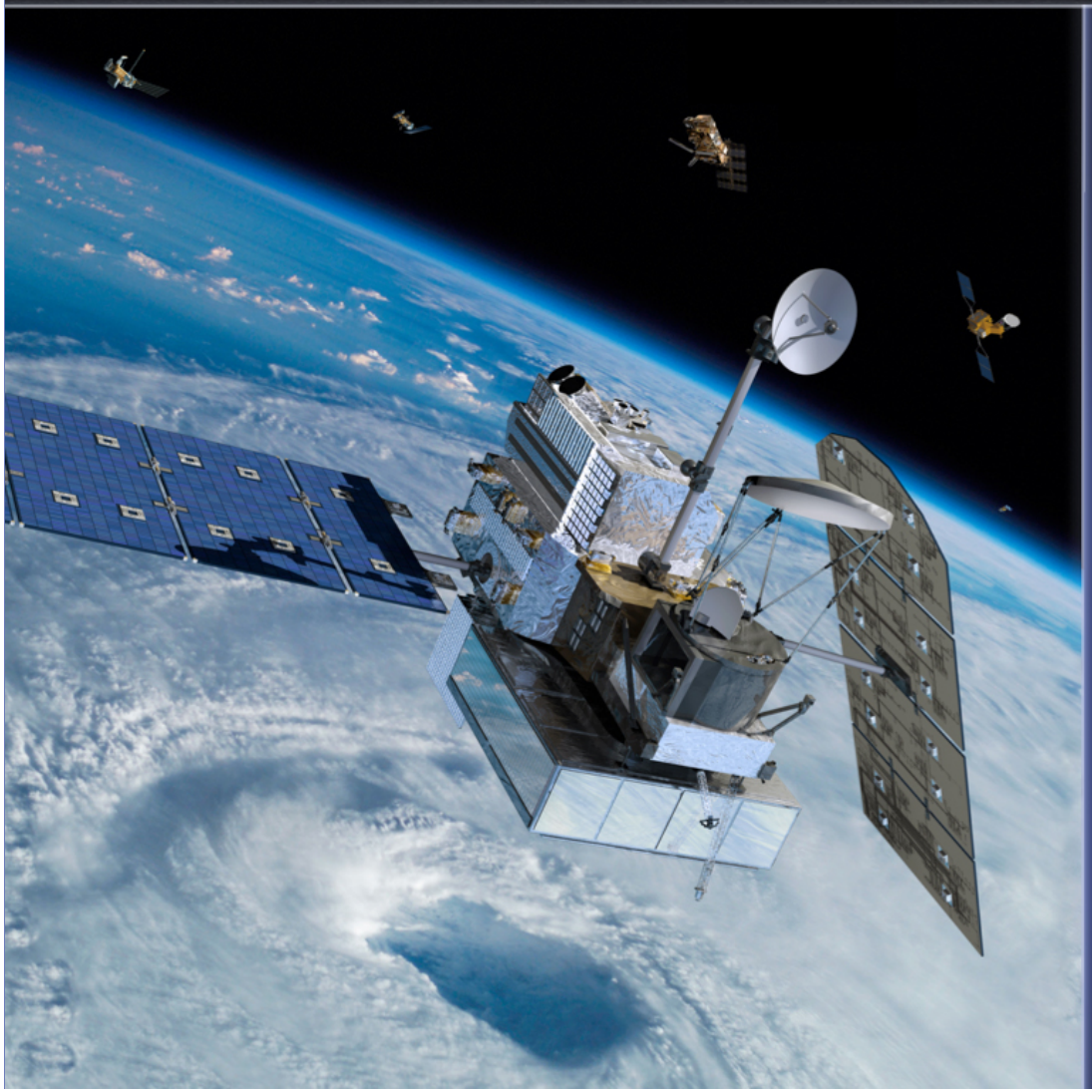
GPM Science Status



Gail Skofronick Jackson

GPM Project Scientist

NASA Goddard Space Flight Center

PMM Science Team Meeting

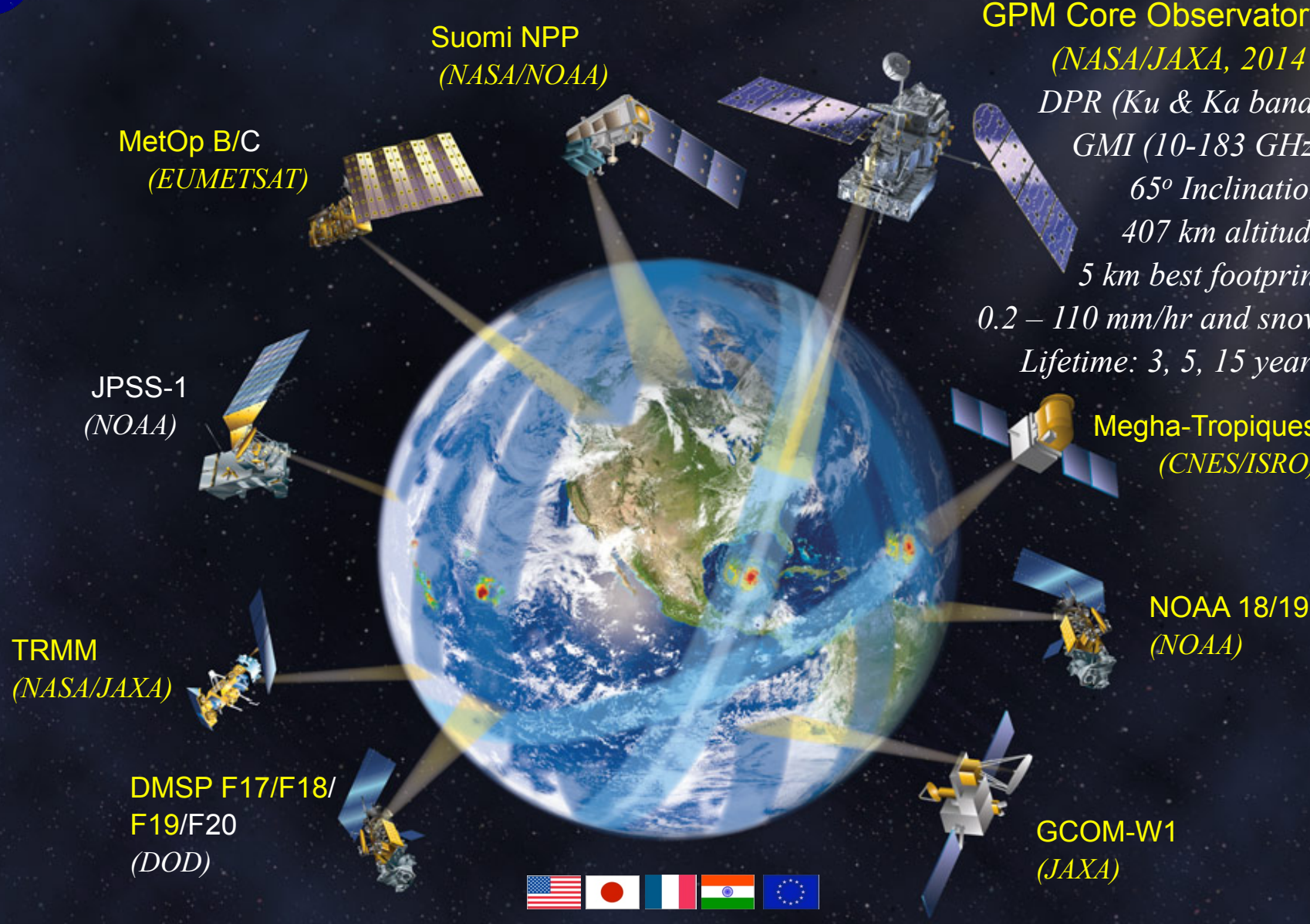
14 July 2015

www.nasa.gov/gpm

Twitter: NASA_Rain

Facebook: NASA.Rain

GPM Constellation Concept

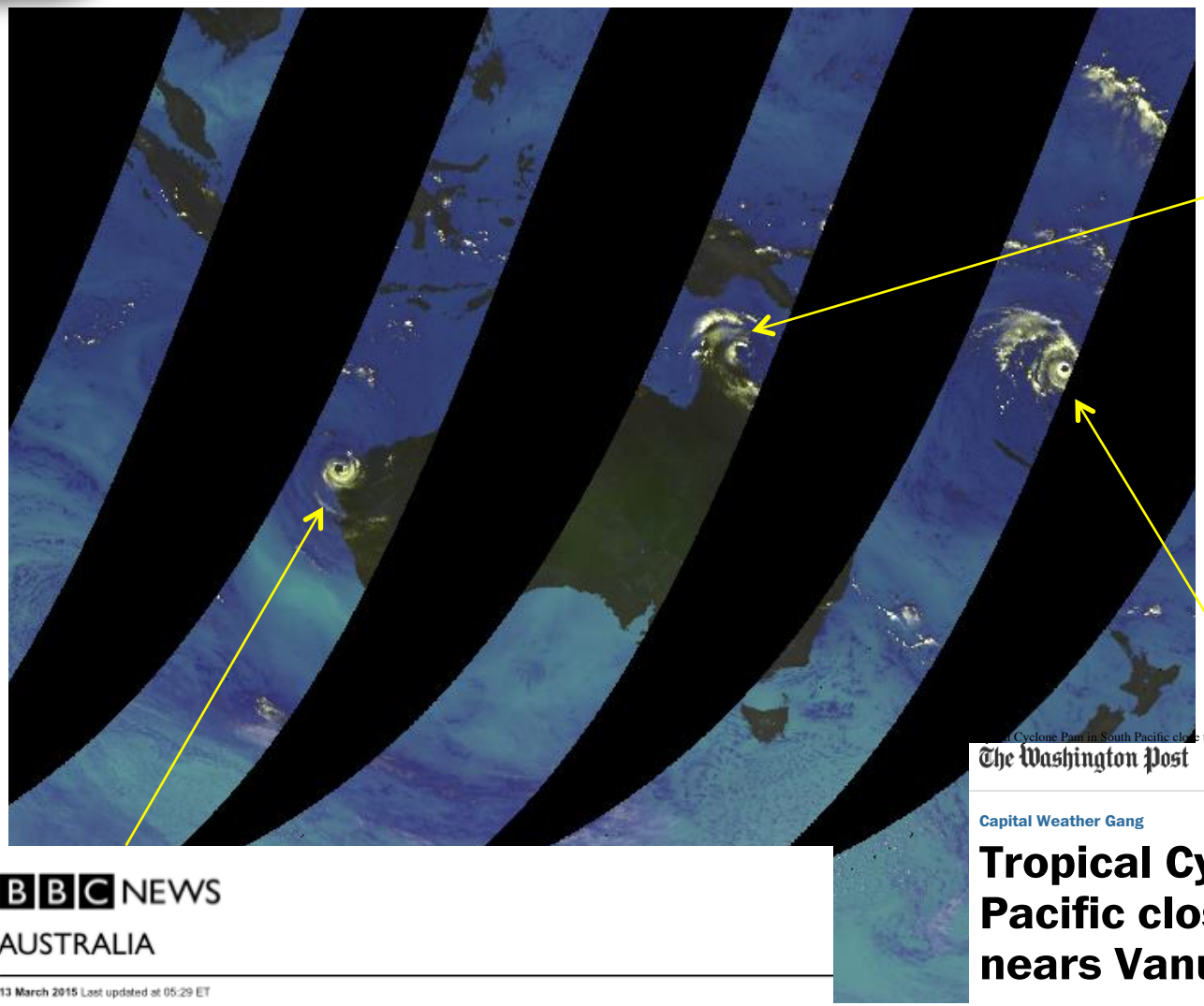


Next-Generation Unified Global Precipitation Products Using GPM Core Observatory as Reference

Precipitation rates everywhere in the world every three hours

GPM Observes Three Cyclones in One Day

GLOBAL PRECIPITATION MEASUREMENT

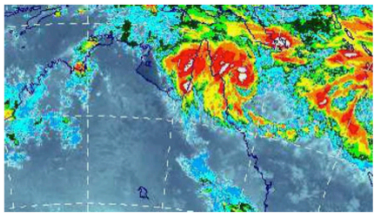


March 12, 2015

Nathan

An island resort devastated by Cyclone Ita almost a year ago has had to delay its reopening, pending yet another unwanted guest: Cyclone Nathan.

With destructive winds forecast to lash Lizard Island, off north Queensland, completion of the $30 million renovation project is expected to be delayed.



Cyclone Nathan is on track to develop into a category three system as it brings destructive winds to far north Queensland. Photo: ABC

About 180 staff and contractors were evacuated from the island on Tuesday.

BBC NEWS

AUSTRALIA

13 March 2015 Last updated at 05:29 ET

Cyclone Olywn brings winds to Western Australian coast

A severe tropical cyclone has hit the coast of Western Australia, bringing heavy rain and hurricane-force winds.

Category three Cyclone Olwyn is now heading towards Perth, having weakened after making landfall near Exmouth on Wednesday night.

Cyclone Pam in South Pacific close to Category 5 as it nea... http://www.washingtonpost.com/blogs/capital-weather-gang

The Washington Post

Capital Weather Gang

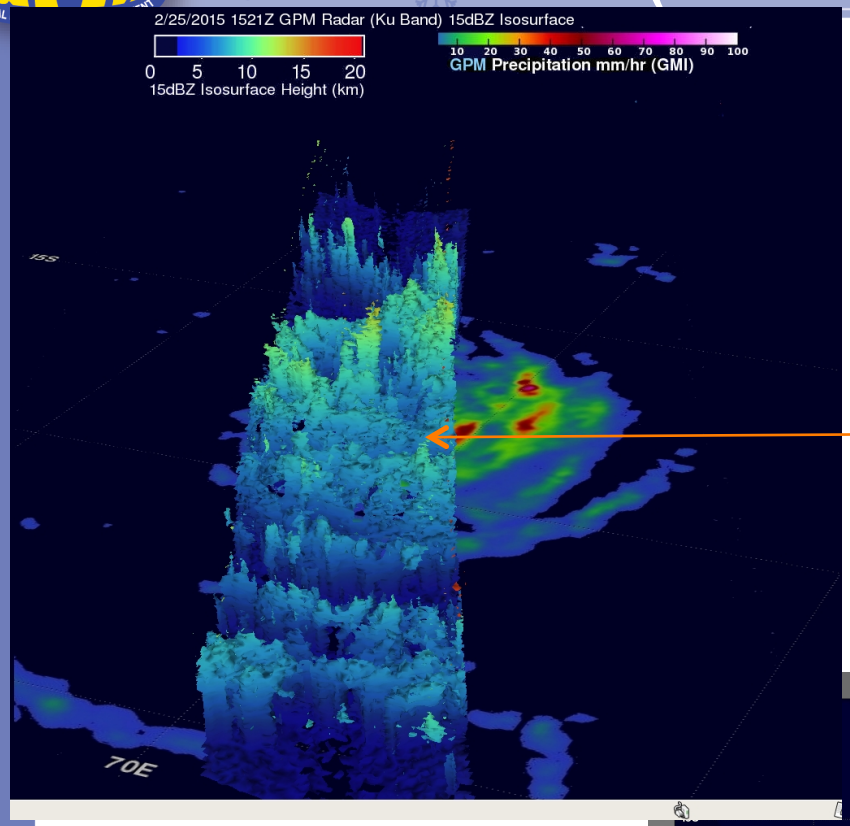
Tropical Cyclone Pam in South Pacific close to Category 5 as it nears Vanuatu

By Angela Fritz March 12 at 2:38 PM

Update: *Vanuatu island of Efate takes direct hit from category 5 Pam*

Tropical Cyclone Pam is strengthening as it tracks just east of the islands of Vanuatu, threatening the island that is home to the capital with winds up to 100 mph.

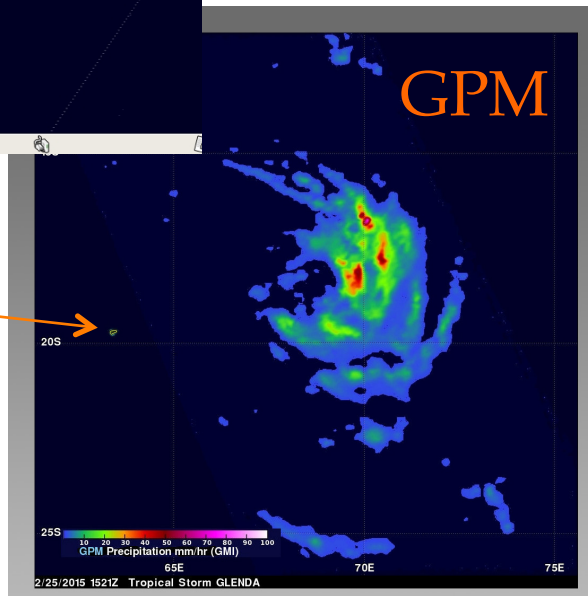
GPM &TRMM (3 min later) observe TS Glenda



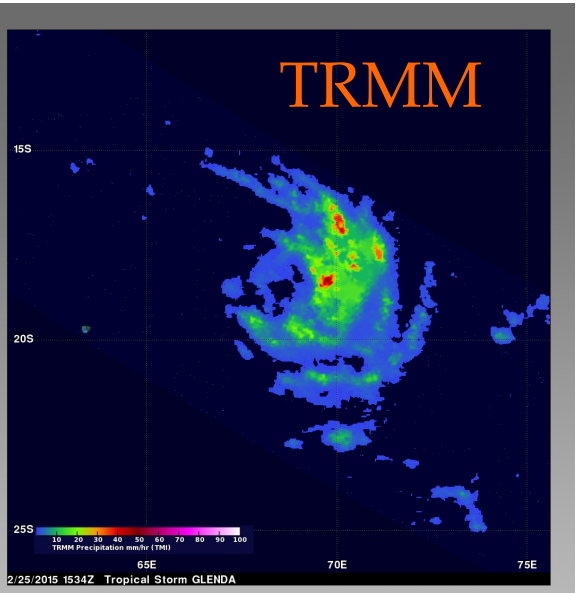
Tropical storm Glenda in the South Indian Ocean on February 24, 2015

GPM Radar Data

TRMM and GPM radiometer observations 3 minutes apart

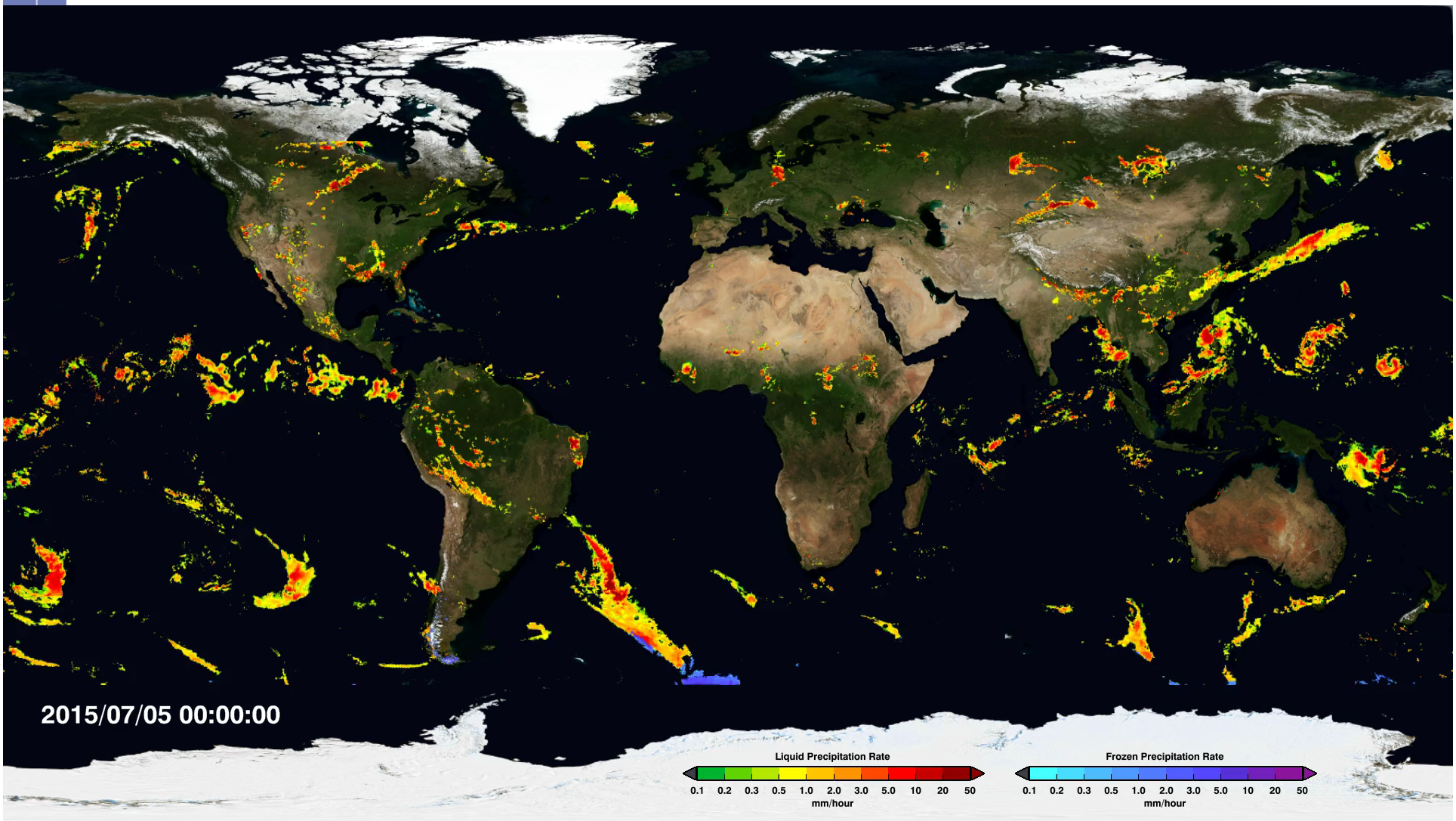


GPM GMI 2/25/2015 1521Z



TRMM TMI 2/25/2015 1534Z

IMERG Rain (5-12 July 2015)



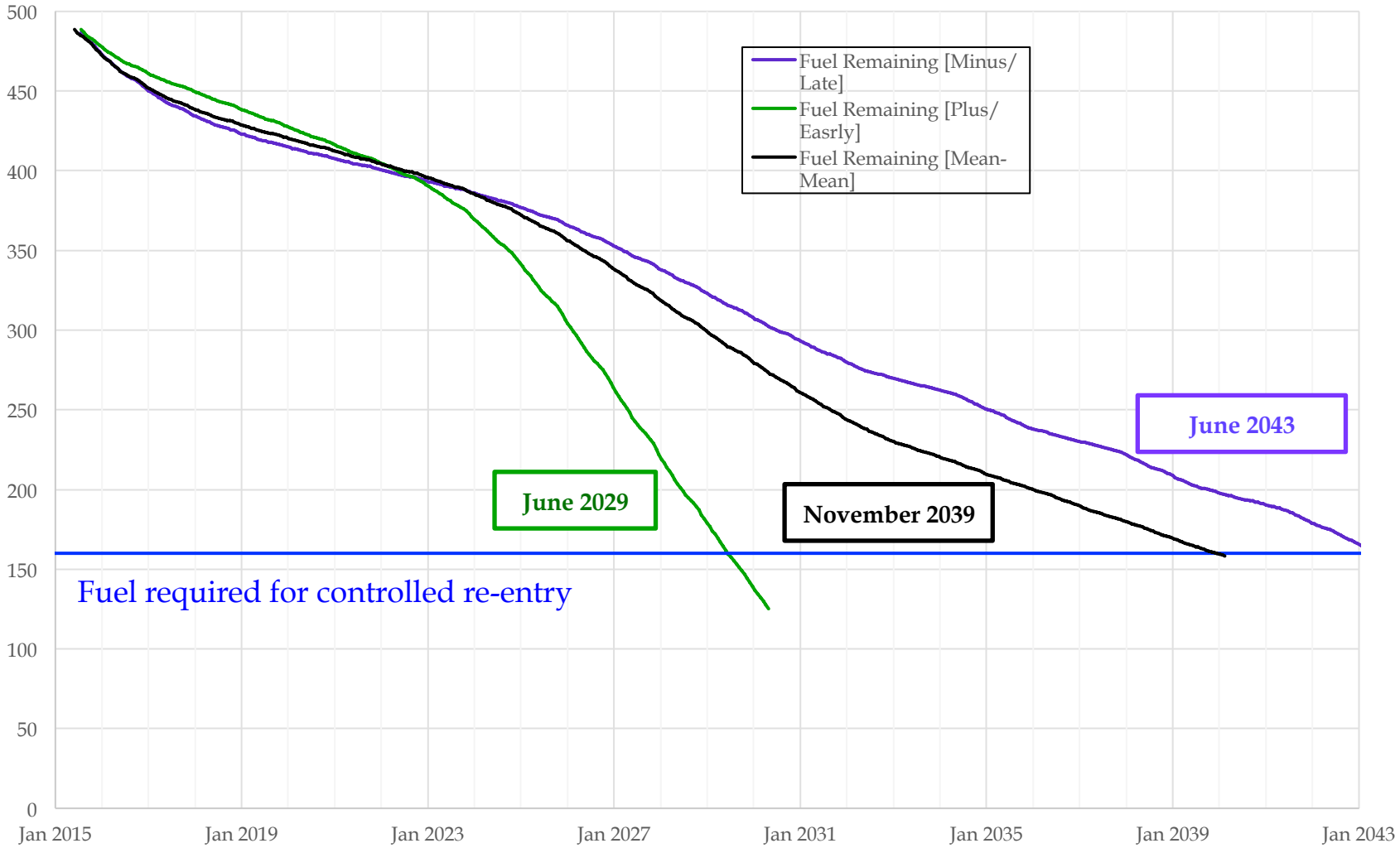
30 minute by 0.1deg by 0.1deg; available ~ 4-6 hours after obs.

GPM Instruments and Data

- DPR is performing well
- GMI deemed best calibrated radiometer (See Wilheit talk)
- GPM Version 04 (V04) reprocessing schedule (See Stocker talk)
- Meeting Data Latency Requirements nearly 99% of the time

Month	1c (GMI Brightness)	Gprof (GMI Precipitation)	Combine (DPR/GMI Precipitation)
June 2014	99.932%	99.225%	88.056%
July 2014	98.993%	99.866%	97.361%
August 2014	98.488%	94.288%	51.075%
September 2014	99.638%	99.445%	64.312%
October 2014	90.313%	90.289%	89.792%
November 2014	99.965%	99.931%	99.167%
December 2014	97.771%	97.749%	97.581%
January 2015	99.963%	97.479%	99.554%
February 2015	96.822%	96.648%	95.913%
March 2015	99.960%	98.958%	99.199%
April 2015	98.024%	98.000%	97.055%
[1]May 2015	99.061%	98.945%	97.840%

Spacecraft Fuel/Lifetime Predictions



GPM Ground Validation Activities

- GPM 7th International GV Workshop, Seoul, South Korea, 12-14 May 2015 (see Petersen talk)
- OLYMPEX Field Campaign: Winter of 2015-2016 (see McMurdie talk)
- Gail's Challenge to GV, algorithm & science teams: Prove that GPM meets Level 1 science requirements

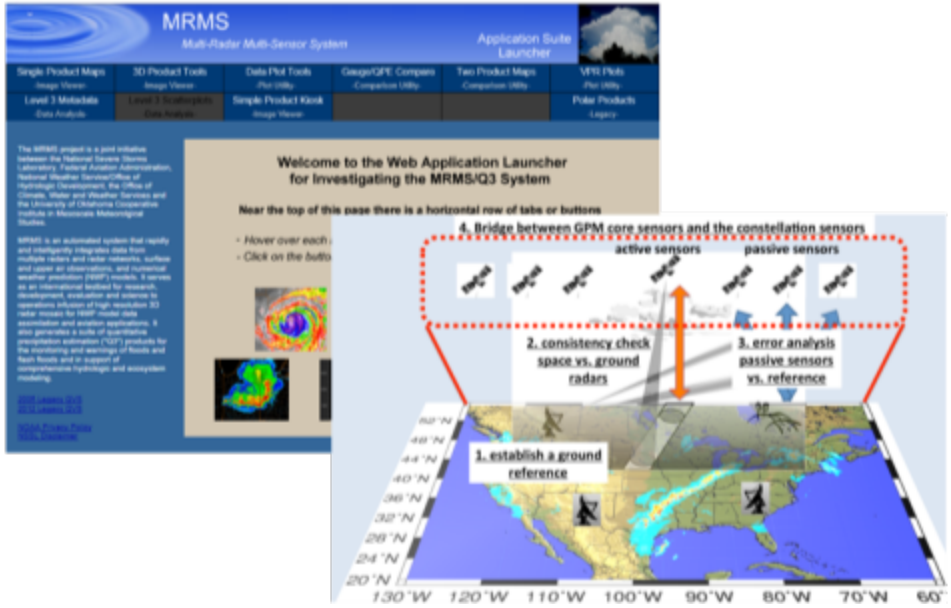
GPM Mission NASA HQ Level 1 Science Requirements

1. DPR: **quantify rain rates** between ***0.22*** and 110 millimeter (mm) per hour (hr) and demonstrate the *detection of snowfall* at an effective resolution of 5 km.
2. GMI: **quantify rain rates** between ***0.2*** and 60 millimeter (mm) per hour (hr) and demonstrate the *detection of snowfall* at an effective resolution of 15 km.
3. Measurements from the Core observatory, shall estimate the **D_m of precipitation particle size distribution to within +/- 0.5 mm.**
4. Instantaneous rain rate estimate with bias and random error **<50% at 1 mm hr^{-1} and <25% at 10 mm/hr at 50 km resolution** between Core Observatory and calibrated ground validation data.

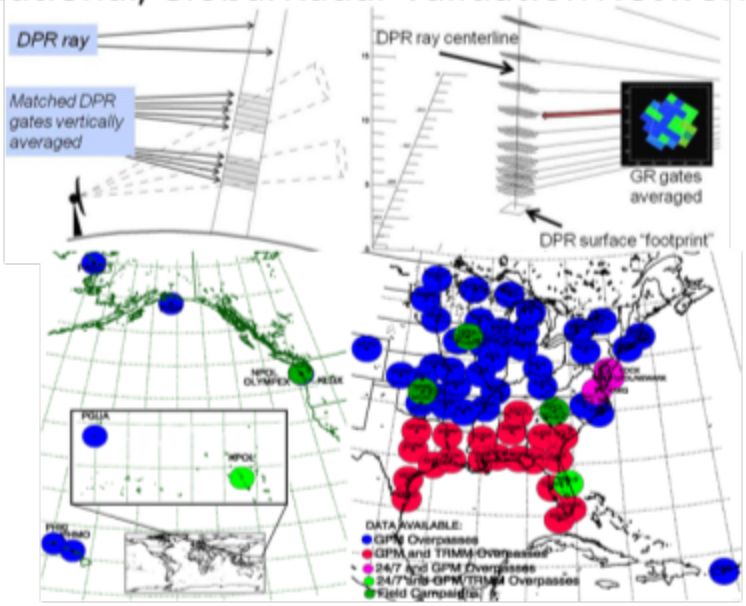
Ground Validation: Tools, Data, Analysis

GLOBAL PRECIPITATION MEASUREMENT

National Merged Radar and Gauge GV (MRMS)

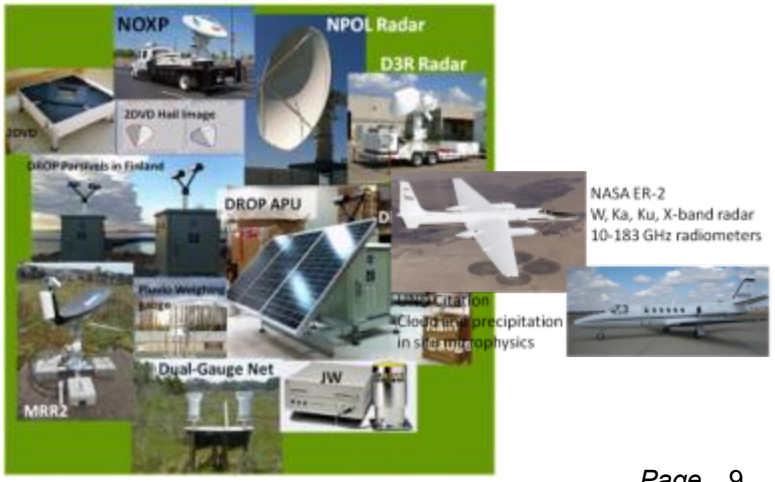


National/Global Radar Validation Network



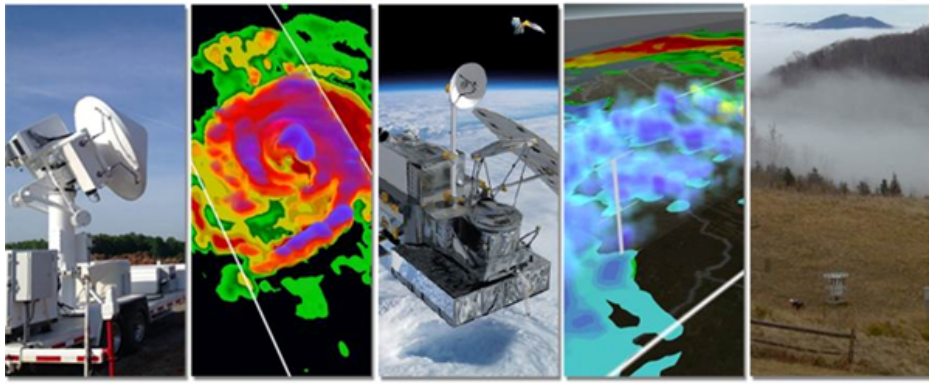
Regional Networks, Tier 1 Sites…….

Field Campaign Instruments and Data

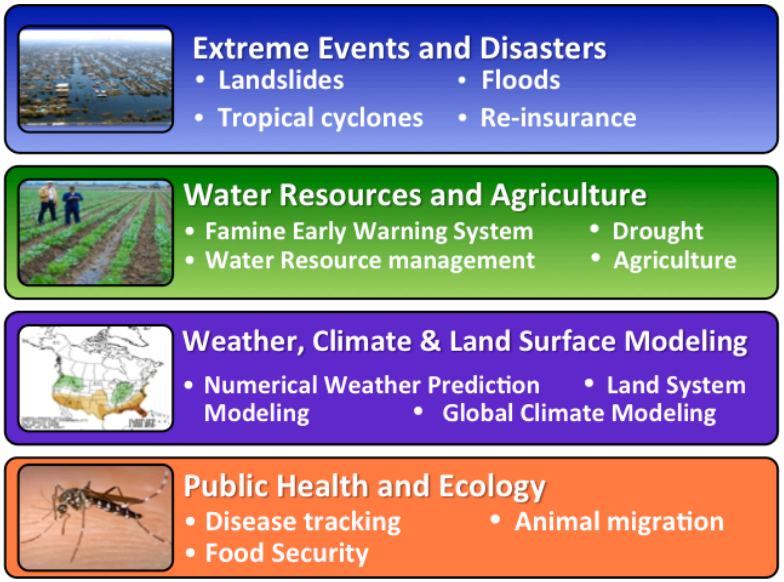


Applications/Education & Public Outreach

2015 GPM Applications Workshop



9-10 June 2015 (See Kirschbaum talk)



Social Media (June Stats)

Twitter: NASA_Rain

Total Twitter Followers: 13547

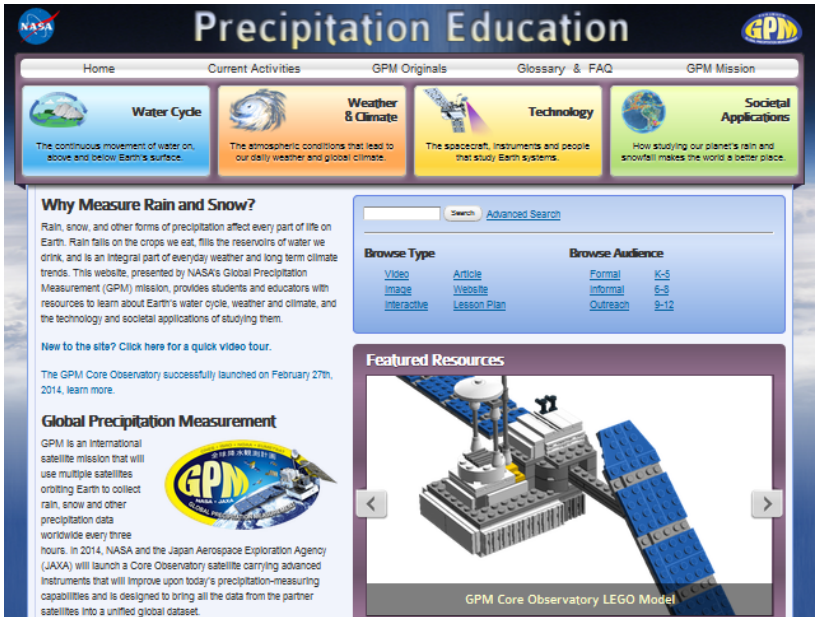
Facebook: NASA.Rain

Total Facebook Followers: 21586

gpm.nasa.gov Pageviews: 43291

gpm.nasa.gov/education Pageviews: 49297

Movie webpage: svs.gsfc.nasa.gov



PMM Science Team Composition

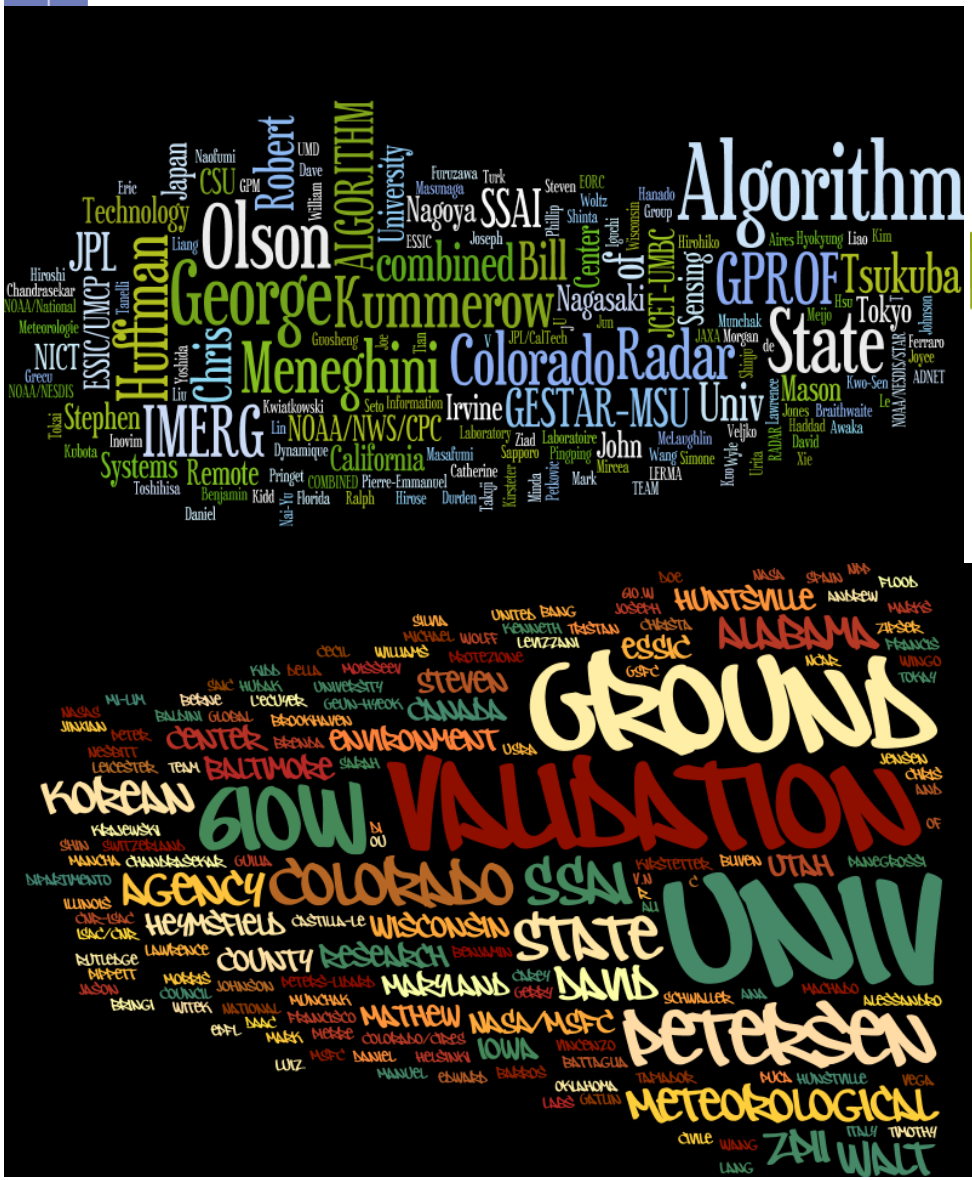
- 56 NASA HQ ROSES funded Principal Investigators (end of three year cycle)
- 24 International Principal Investigators (no cost teams) from more than 30 countries
- Working groups:

Working Group	Lead
Land Surface	Turk
Latent Heating	Tao/Takayabu
Hydrology	Peters-Lidard
Ground Validation	Petersen
PSD	Williams
Applications	Kirschbaum
Conv./Strat. Separation	new; ?
X-Cal	Wilheit ➔Berg
GPROF	Kummerow
Combined	Olson
Radar	Iguchi/Meneghini
Multi-Satellite	Huffman

Algorithms

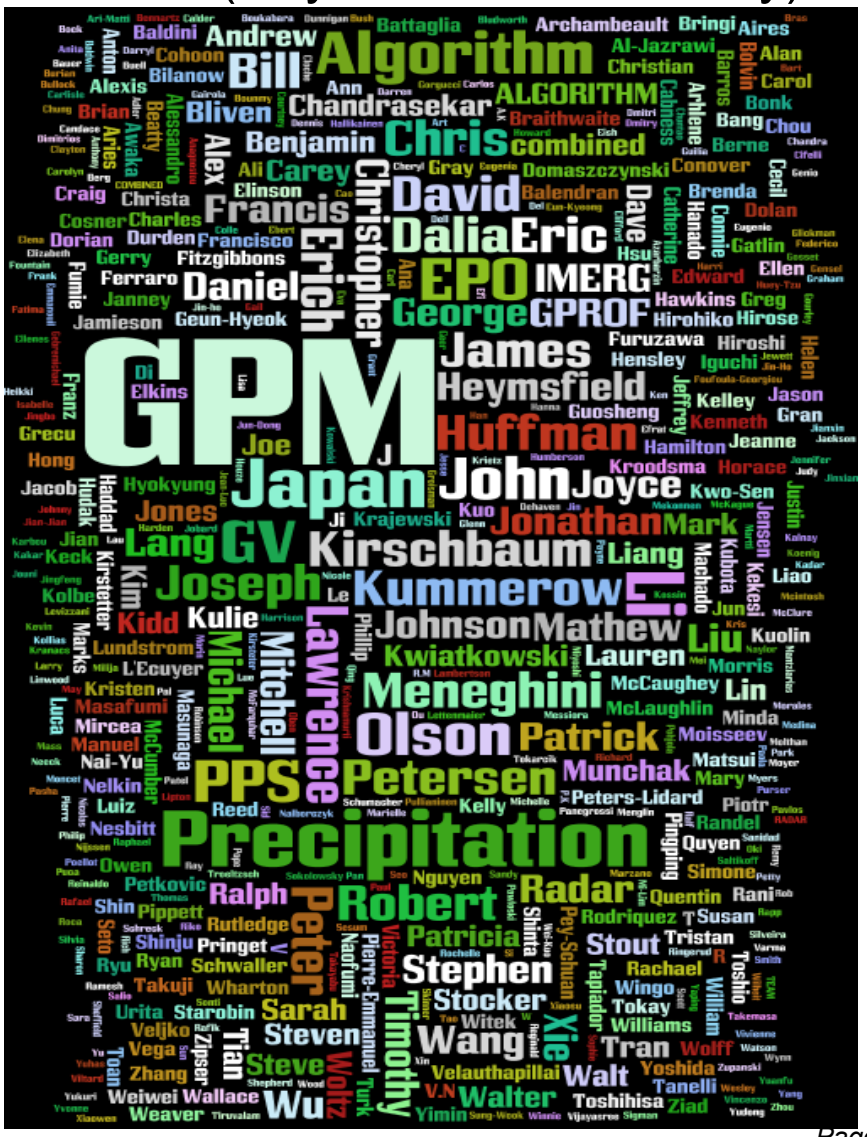
Science Team Status: Awards Deluge!

NASA Robert H **Goddard Center** group awards for the Algorithm, GV, PPS, and EPO Teams (award ceremony early 2015)

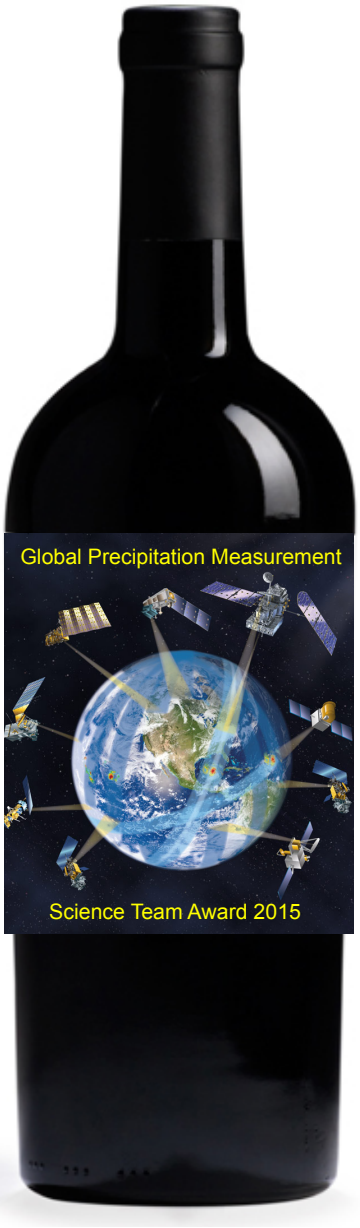


More Awards Rain Down!

NASA Agency Distinguished Service Medal for Arthur Hou, a group award for the GPM Post Launch Team (July 8 award ceremony)



Today's Science Team Awards



Arthur's tradition: Award WG/ team that improves algorithm performance using actual data

This Year's theme is Constellation Algorithm Improvements

Contributions to Constellation Algorithms

Citation: For providing the base information necessary for consistent constellation products

Tom Wilheit and the Intersatellite Calibration Team

Citation: For providing a significant fraction of the GPM constellation estimates

Chris Kidd (Cross Track Sounder Algorithms)

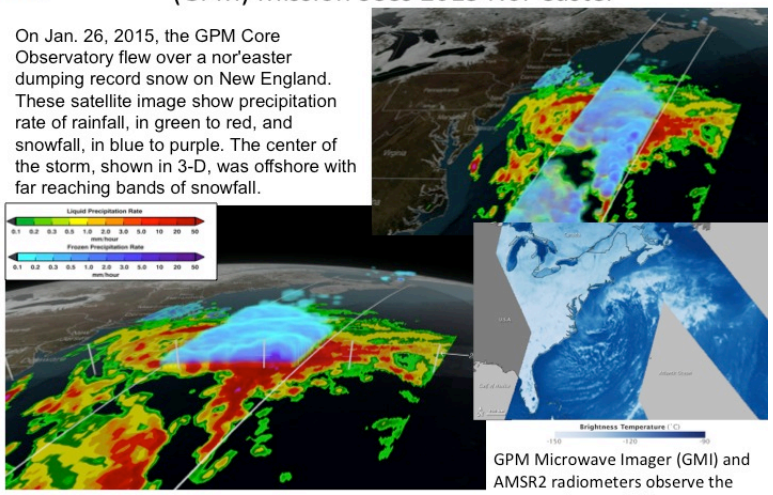
Looking Forward (1/2)

- **Major Reviews in Spring 2017**
  - NASA HQ End of Prime Mission Review
  - NASA HQ Senior Review
  - NEED PMM team to *validate GPM Level 1 Science Requirements*
  - NEED your *GPM Science Highlights* and listing of your *GPM publications (send to Lisa, Gail, George, and/or Dalia)*

Science Highlight Example

Global Precipitation Measurement (GPM) Mission Sees 2015 Nor'easter

On Jan. 26, 2015, the GPM Core Observatory flew over a nor'easter dumping record snow on New England. These satellite image show precipitation rate of rainfall, in green to red, and snowfall, in blue to purple. The center of the storm, shown in 3-D, was offshore with far reaching bands of snowfall.



Credits: Alex Kekesi, Earth Observatory

GPM Microwave Imager (GMI) and AMSR2 radiometers observe the storm on January 27th

Name: Dalia Kirschbaum ,NASA/GSFC, Code 617
E-mail: dalia.b.kirschbaum@nasa.gov
Phone: 301-614-5810

Abstract: At 5:05 p.m. EST Monday, Jan. 26, 2015, the Global Precipitation Measurement mission's Core Observatory flew over the nor'easter dumping snow on New England. This satellite image shows precipitation rate of rainfall, in green to red, and snowfall, in blue to purple. The center of the storm, shown in 3-D, was offshore with far reaching bands of snowfall. More intense snow rates are shown in shades of blue, which can be seen on the northern edge of the storm and also over land up the coast from New York to Maine and into Canada, as well in the upper atmosphere before turning to heavy rainfall over the ocean.

References:
http://svs.gsfc.nasa.gov/cgi-bin/details.cgi?aid=4266

Data Sources: Global Precipitation Measurement Microwave Imager (GMI) and Dual-frequency Radar (DPR)

Technical Description of Figures:

Figure 1 (top right) Overhead view of the GMI and DPR instruments showing the two swath extents (DPR: KaPR = 120 km, KuPR = 245 km; GMI: 885 km). Blue denotes snow and red to green colors show rain.

Figure 2 (bottom left) Same view of the storm but looking at a cross section through the DPR.

Figure 3 (bottom right) GMI and AMSR2 radiometer measurements observed for the same storm on January 27th, 2015. Blue indicates bright temperature (in degree C)

Scientific significance:
The GPM Core Observatory is the first satellite specifically designed to measure falling snow. The DPR can also provide important clues into how snow, ice and rain are distributed in a storm. In this example, we are able to observe this significant East Coast Nor'easter as it is intensifying over the ocean. The DPR also demonstrates the capability to observe the melting layer (difference between solid and liquid precipitation) within the storm.

Relevance for future science and relationship to Decadal Survey:
The Global Precipitation Measurement (GPM) mission is an international network of satellites that provide the next-generation global observations of rain and snow. Building upon the success of the Tropical Rainfall Measuring Mission (TRMM), the GPM concept centers on the deployment of a "Core" satellite carrying an advanced radar / radiometer system to measure precipitation from space and serve as a reference standard to unify precipitation measurements from a constellation of research and operational satellites.

Credits:
Alex Kekesi (GST), Lead Animator, **Greg Shirah** (NASA/GSFC), Animator, **Ryan Fitzgibbons** (USRA), Lead Producer
Rani Gran (NASA/GSFC), Producer, **Gail Skofronick Jackson** (NASA/GSFC), Lead Scientist, **Dalia B Kirschbaum** (NASA/GSFC), Lead Scientist
George Huffman (NASA/GSFC), Lead Scientist, **Laurence Schuler** (ADNET Systems, Inc.), Lead Project Support
Ian Jones (ADNET Systems, Inc.), Project Support, **Ellen T. Gray** (ADNET Systems, Inc.), Lead Writer

Looking Forward (2/2)

- **Special Journal Issue**
  - Virtual Collection (can span different issues and journals; AMS?)
  - Can be bound when “completed” for a paper copy
  - NEED your paper titles/authors/preferred journal if you are interested in participating
- **AGU Special Session**
  - H049: Global Precipitation Measurement, Validation, and Applications, Session ID 7594
- **GPM Apparel**
  - http://ocs.landsend.com/cd/frontdoor?store_name=GPM&store_type=3